Contribution ID: **97** Type: **not specified**

Revisiting the Rhoades-Ruffini Bound

Wednesday 24 September 2025 11:00 (30 minutes)

We revisit the derivation of the Rhoades-Ruffini bound [1] of 3.2 M⊙ for the upper limit of the maximum mass of neutron stars. We find that the assumption made there for the onset density of an ultimately stiff phase of high-density matter is not stringent. Relaxing this assumption and allowing for an onset of stiff non-nucleonic constant-speed-of-sound matter under neutron star constraints at the saturation density or below boosts the upper limit of the theoretically possible maximum mass to 4 M⊙ or higher. We provide a fit formula for the dependence of the maximum mass on the speed of sound and the onset density of the phase transition [2]. Our findings are relevant for discussing the nature of the so-called mass gap objects in the mass range between 2.5 and 5 M⊙.

[1] C.E. Rhoades and R. Ruffini, Maximum Mass of a Neutron Star, Phys. Rev. Lett. 32, 324 (1974) [2] D. Blaschke and A. Wójcik, Revisiting the Rhoades-Ruffini Bound, in preparation (2025)

Author: Prof. BLASCHKE, David (David Blaschke1, 2, 3, ⋆ and Adrian Wójcik1, † 1 Institute of Theoretical Physics, University of Wroclaw, Max Born Pl. 9, 50-204, Wroclaw, Poland 2Helmholtz-Zentrum Dresden-Rossendorf, Bautzner Landstrasse 400, 01328 Dresden, Germany 3Center for Advanced Systems Understanding (CASUS), Untermarkt 20, 02826 Görlitz, Germany)

Presenter: Prof. BLASCHKE, David (David Blaschke1, 2, 3, ⋆ and Adrian Wójcik1, † 1 Institute of Theoretical Physics, University of Wroclaw, Max Born Pl. 9, 50-204, Wroclaw, Poland 2Helmholtz-Zentrum Dresden-Rossendorf, Bautzner Landstrasse 400, 01328 Dresden, Germany 3Center for Advanced Systems Understanding (CASUS), Untermarkt 20, 02826 Görlitz, Germany)